Midwest Engineer

SERVING THE ENGINEERING PROFESSION

WESTERN SOCIETY OF ENGINEERS
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WELDING SEQUENCES AND USES OF HEAT — PAGE THREE

Vol. 6 JULY, 1953 No. 2

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Midwest Engineer

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Serving the Engineering Profession

JULY, 1953 Vol. 6, No. 2

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Cover Story

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In Structural Fabrication

Welding Sequences and Uses of Heat

By F. H. Dill

When fabricators of steel structures began to use welding they found a behavior quite contrary to their usual experience. Structures or structural members made by riveting, they found, tend to grow or increase in dimensions as they are made. Welded structures and members shrink. It was not long until the statement, "Welding always causes shrinkage," became accepted as an axiom by persons who use welding.

There are really two phenomena involved in the shrinkage that accompanies welding. The obvious one is the contraction of the weld metal after it has solidified. This would be a shortening of about 1/64 inch in each inch of weld length if there were no restraint of it. The less obvious shrinkage is that which develops in the base metal that is heated in the course of the welding operation. The mechanism of this shrinkage is rather complex, but it is important because this shrinkage is often the predominant one.

The elements involved in this shrinkage are:

1. The thermal expansion of the steel.
2. The stress necessary to restrain or prevent thermal expansion.
3. The plastic deformation or permanent set that results from application of the stress that will restrain or prevent thermal expansion.

Structural steel has a coefficient of expansion of approximately .0000067. Heating a bar of structural steel to a temperature 180°F above its initial temperature will increase its length .0012 inch in each inch of length—a little more than ⅛ inch in 10 feet. If the bar were heated and cooled uniformly and with no restraint, its length, upon return to the initial temperature would be the same as it was originally. With only this much heating, the length of a piece of ordinary structural steel after cooling would also be the same as the original length if the expansion had been completely restrained. This is because a stress of only 36,000 psi, which develops an elastic deformation of .0012 inch per inch, is all that would have to be applied to prevent the thermal expansion. This stress is approximately the yield point stress for ordinary structural steel and only elastic stress would have been imposed in restraining the thermal expansion. As a result, there would not have been any permanent change of dimension.

Now suppose the bar were to be heated to a temperature 400°F above its initial temperature, i.e. to 450°F. Its normal thermal expansion would be .0027 inch per inch. Restraint of this expansion, however, would still require a stress of nearly 36,000 psi but only .0012 inch per inch of the deformation caused by this stress would be elastic. There would be a permanent set of .0015 inch per inch and the bar would be shorter by this much after it cooled to its initial temperature.

Suppose again that the bar was heated to a temperature 1000°F above its initial temperature, i.e. to 1050°F. The expansion would be approximately .0067 inch per inch, but at this temperature the yield point of the steel might be only 20,000 psi. If the expansion were restrained, only this much stress would be finally required and only .0007 inch per inch of the expansion would have been absorbed as elastic deformation. There would be permanent set of .0060 inch per inch and the bar would be shorter by this amount after it had returned to its initial temperature.

It can be concluded from consideration of these conditions that steel which is heated under complete restraint in one or more directions will be permanently shortened, after cooling to its initial temperature, if it is heated more than about 180°F. above its initial temperature. The higher the temperature, the greater will be the amount of the shortening.

When this idea is applied to analysis of weld shrinkage or to the use of localized heating for straightening or forming steel it is apparent that there is seldom, if ever, truly complete restraint of the thermal expansion. Metal adjacent to the heated spot or along the heated line is ordinarily the only restraint against the thermal expansion, and it undergoes elastic deformation in developing the stress necessary to contain the expansion. The shortening of the heated metal is consequently not as great as it would be under complete restraint, and it requires a temperature rise greater than 180°F to initiate permanent shortening of the heated metal. The actual amounts and temperatures, as would be expected, depend greatly on the size and shape of the piece involved and on the exact nature of the heating. Practical experience shows, however, that localized heating to even 400°F will usually result in some observable distortion of the piece. The amount of shortening of any specific temperature is rather unpredictable, but it is ordinarily perhaps half of that which might be expected from completely rigid restraint of the thermal expansion.

Welding Shrinkage

Having examined the nature of weld shrinkage, it is in order to give it some quantitative consideration. Measurements of welding shrinkage and experience have led to three fairly reliable rules for estimating its amount:

1. A shortening of about ⅛ inch in each 10 feet of length or width can be expected in structural members with an average amount of miscellaneous welding.
2. A shortening of about .02 inch may be expected across a line of fillet welds or a line of plug welds.
3. A shrinkage of 1/32 to ⅛ inch, averaging 1/16 inch, can be expected across a butt-welded joint.

These may seem like small amounts, but they indicate a probable shrinkage of 1¼ inches in the length of a 100 foot long girder, or a shrinkage of 2½ inches in the length of a steel bridge floor that has 20 butt welds and 60 lines of plug welds in a length of 120 feet.

With this recognition of the magnitude of weld shrinkage it is next desirable to

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F. H. Dill, Welding Engineer, American Bridge Division, United States Steel Company, Ambridge, Pa., presented this talk before the April 20, 1953 meeting of the Western Society of Engineers at the Society's Headquarters in Chicago.

Above, left to right, James W. Schaefer (holding Service Award), Ovid W. Eshbach and Miss Lillian Stemp (receiving Cash award).

Above, left to right, Ovid W. Eshbach, Virgil E. Gunlock and Charles E. DeLeuw.

WSE Holds Annual Meeting

Over 450 persons attended the Western Society's Annual Dinner at the Furniture Club of America in Chicago on May 25.

Ovid W. Eshbach, the retiring President of the Society, opened the meeting following dinner. He introduced the members of the Board of Direction, then read the names of the new life members. H. P. Sedwick, a Past President of the Society and himself a new life member, accepted a token presentation of life membership, then presented the diplomas to the other new life members and congratulated them as their names were read. President Eshbach then presented a Prize Paper Award of $100 to Miss Lillian Stemp for her paper on "The Engineer and the Prospective Employer;" and a Service Award to James W. Schaefer "In Recognition of his work as Chairman of the Advertising Committee for 1952-53."

Next, President Eshbach gave a summary of the activities of the past year, here given in part:

"I should like to give you a brief summary of activities for the past year.

"Mr. Allan Bulley, our treasurer, reports we had a good year financially. This is the fourth successive year we operated in the black. Under the leadership of Mr. Charles DeLeuw and with the cooperation of a committee of approximately 80 members, the expansion committee is assured of raising the necessary funds to enlarge our dining room and provide offices and meeting rooms for other societies who would like to be housed at our headquarters. We graciously acknowledge the support of the industries, societies and our membership in the effort.

"Increasing our membership, particularly from the younger groups has been and will continue to be an activity needing more general support. Mr. Henry W. Coffman, as chairman, has been studying with his committee ways and means of establishing better continuity of effort and wider participation of individuals. Mr. Boris Woloskin, chairman of the admissions committee, also recommends continuity in committee appointments to better transmit experience from one year to the next. At present we expect to close the year with approximately 175 new

Above, left to right, Robert S. Hammond, Alf Kolflat, Thomas M. Niles and J. Earl Harrington.

Above, left to right, Charles E. DeLeuw, H. P. Sedwick and John F. Sullivan, Jr.

Above, left to right, Lillian Stemp, J. T. Rettaliata, George L. Seaton, Bruce A. Gordon, Robert S. Hammond and Alf Kolflat.

Above, left to right, Clifford B. Cox, Allan A. Bulley and James W. Schaefer.

members. A quota considerably larger than this should be possible.

"The program committee under the chairmanship of Robert Zinn provided a series of excellent programs on the second and fourth Monday of each month from October to May. Supplementing the program committee was an attendance committee aiding the regular publicity of the central office.

"On the whole it was a successful year with active participation of the ten sections.

"The sections averaged three meetings each for the season. In addition to approximately three dozen technical meetings, numerous other sessions and committee meetings were scheduled.

"There are many noteworthy activities which time will not permit reporting, but I should like to compliment the Junior Division on their efforts and cooperation in connection with the Centennial of Engineering program last September. Also the Women's Council who were most consistent in scheduling their regular meetings.

"The most outstanding activity of the Council this year was the participation in the Society's Convention which was held in honor of the Centennial of Engineering. At that time the Society acted as host to the Society of Women Engineers. It was quite an honor and the chairman, speaking for the Council, has expressed appreciation.

"One of the activities connected with the Convention was the collecting of the names of women engineers in this country and Canada, that they might be invited to the Convention. It was quite an undertaking to be done in such a short time. The Council, with the help of the Society, was able to invite over 2000 women engineers to participate. To tabulate this list for future use is still the ambition of the Professional Women's Council.

"Your general committees, too, have been very active and have a good record for their efforts.

"The House Committee under Chairman D. J. Clynes has been pressed by current plans for expansion and anticipating this, confined expenditures for decorating to a minimum.

"The library committee under Dean R. G. Owens is endeavoring to increase the flow of books for review which, because of library limitations, has not been as urgently demanded in the past.

"I am pleased to report that our Publications Committee, under Leroy Bernhard, has our Midwest Engineer back on schedule. We all owe an expression of appreciation to our Managing Editor, Mr. Harold K. Eaton, who has done an excellent job in doing an almost impossible task.

"You have already heard of the good work of our Advertising Committee and the report of the Awards Committee, under Mr. Harry Hagedorn, that its chairman, Mr. James W. Schaefer, be given a service award. Notwithstanding the competition of the drive for headquarters improvements, they maintained excellent support through sales of advertising space and have organized a program which can be continuous and effective.

"I have a long report from our Civic Committee Chairman, Mr. Barry Kostenko. This is a large committee of 65 members, of which one quarter were appointed for the first time. They represent a variety of engineering experiences. The Committee held regular monthly meetings with excellent attendance, and in

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Above, left to right, Donald N. Becker, Albert P. Boysen, Virgil E. Gunlock (speaker) and Ovid W. Eshbach.

Above, left to right, George L. Jackson, Mrs. Dot Merrill, Wm. R. Marston, F. A. Hess and Clifford B. Cox.

(Continued from Page 5)
addition to many sub-committee conferences sponsored six technical sessions. The benefits derived by the community and members are in direct proportion to the interest and effort of the individuals. They have been able to keep abreast of civic matters, not only in Chicago, but in the entire Metropolitan area and have contributed by their studies and recommendations to many of the improvements which sometimes, only after the passage of time, have made the community better and more efficient.

"Your Committee on Education, which is a member of and cooperates with a Joint Educational Committee of the several professional societies in Chicago, has made what they call an annual progress report. Under the chairmanship of Mr. Charles Blessing, who was later succeeded by Mr. W. W. Pomerhn, a remarkably successful program was undertaken. After a thorough survey of industrial leaders to establish the kind of educational needs of the membership, they organized a two-semester program of courses in subjects such as Human Relations in Management (5 sessions with 100 participants), Rapid Reading (100 participants), Effective Training and Business Management (2 semesters —110 participants), Conducting a Conference, which was an experiment with a small conference group and will probably be quite popular in future years, and a program of refresher courses for the applicants for license, in which the committee cooperated with educational institutions in the area in making information available to the membership.

"I know you are all interested in the Young Engineers Forum. Dr. G. Egloff and Mr. W. R. Marston, as chairman and co-chairman, conducted a very successful Forum for approximately 110 young engineers. We are very appreciative of the spirit in which both the speakers and employers have supported this activity.

"This concludes the report of the high spots of our activities, except for our participation in the Centennial of Engineering celebration, in which we were hosts to many organizations.

"We are indebted as always to our diligent and efficient Executive Secretary, Earl Harrington, and his excellent staff.

"In turning the meeting over to your new President, Mr. Charles DeLeuw, I should like to announce that the plans for the improvement of headquarters will be carried out this summer. The dining room will be closed during June, July and August, but will be ready after Labor Day. Thanks to all of you for your fine cooperation."

At the conclusion of his summary, retiring President Eshbach turned the gavel over to the new President, Charles E. DeLeuw. Mr. DeLeuw conducted the remainder of the meeting.

After a few brief remarks, Mr. DeLeuw introduced Virgil A. Gunlock, Commissioner of Public Works, City of Chicago, who was the speaker of the evening. Commissioner Gunlock's subject was "The Business of Building a Big City."

President DeLeuw closed the meeting at the conclusion of Commissioner Gunlock's talk.

ASTM Elects Board

The American Society for Testing Materials announces that Leslie C. Beard, Jr., assistant director of Socony-Vacuum Laboratories, is the Society's new president.

Claire H. Fellows, director, Engineering Laboratory and Research Department, The Detroit Edison Co., is the new ASTM vice president.

The ASTM Board of Directors is now made up of the following: Neil A Fowler, director of sales and research, General Box Co., Richard T. Kropf, vice president, Industrial Thread Division, Belding Heminway Corticelli Co.; Theodore E. Olt, director, Research Laboratories, Armco Steel Corp.; John R. Townsend, director of material and standards engineering, Sandia Corp.; and Kenneth B. Woods, associate director joint highway research project and professor of highway engineering, Purdue University.

***The WSE Bar* will remain open all through the summer. Come in, relax, and enjoy yourself.**

ASHVE Denver Meet Covers Many Topics

The Semi-Annual Meeting of The American Society of Heating and Ventilating Engineers was held June 29, 30-July 1, at the Shirley-Savoy Hotel in Denver. The three-day meeting included four technical sessions on subjects ranging from the physiological reactions of people to environment, to the operations of various types of systems which produce the environment.

Registration commenced on Sunday, June 28, at 10 a.m., and at 9 a.m. on Monday through Wednesday. Reg. F. Taylor, president of the Society and consulting engineer, Houston, Tex., presided at the meeting.

The Monday morning session consisted of three papers, "Performance of a Forced Draft Cooling Tower," "Effect of Relative Humidity on Heat Loss of Men Exposed to Environments of 80°, 76°, and 72°F," and "Experimental Approaches to the Study of Noise Transmission in Piping Systems."

Three papers were presented at the Tuesday morning session. They were: "Electrical Analogger Application to the Heat Pump Process," "Design and Performance of a Residential Earth Heat Pump" and "Moisture Movement in Soils Due to Temperature Difference."

The Wednesday morning session consisted of "Design Data for Slat-Type Sun Shades for Use in Load Estimating," "Automatic Permeance Testing by the Permeometer," "Thermal Performance of Frame Walls, Part II — Air Spaces Blocked at Mid-Height" and "Development of Thermal Conductivity Probe."

The technical papers given at the last session on Wednesday afternoon were: "Performance of Warm Air Perimeter-Loop and Radial Systems in a Residence," "Heat Exchanges in a Floor Panel Heated Room," "Further Studies of Thermal Characteristics" and "Heat Flow Analysis in Panel Heating or Cooling Sections—Case II: Floor Slab on Earth with Uniformly Spaced Pipes at the Slab-Earth Interface."

The program for the Semi-Annual Meeting included a timely variety of subjects which are of great interest and importance to the field of heating and ventilating.

—Words—

By Lewis A. Vincent

All of us here this evening are in engineering work. Being in that field we are occupied with engineering subjects in our daily lives. For that reason, I have chosen the subject "Words." This is not an engineering subject but I feel it represents a field that is becoming more and more important to engineering. That is especially true because the fire protection engineer of all the, branches of this profession is confronted with the need for a skill and facility in proper and effective use of the language both in writing and speaking.

In our field of engineering, we cannot take a picture of a structure or a new machine and say, "This is what we are bringing into the market for the welfare of the public."

We *can* take a picture of ruins or of a machine that has been damaged, maybe beyond use, and say: "Here is a horrible example of what we could have avoided."

I'm afraid that the photograph of ruins, graphic as it is, does not alone have the power to influence the public to use our ideas on fire prevention. In our particular field, there is a real need for being able to use words in a way to convince all those who are in a position to do something toward developing better measures of fire prevention and fire protection.

If we will stop for a minute to think of the power of words, I am sure we can each of us think of some phrase that has a lasting and special significance. Every language, every people and race, in fact, has some rallying cry or slogan. In another sense, maybe not so dramatic, is the statement of Thomas Macaulay, "Every generation enjoys the use of a vast hoard bequeathed to it by antiquity, and transmits that hoard, augumented by fresh acquisitions, to future ages."—Words are the means of doing this.

More and more, engineers are required to write, talk, make speeches and use words accurately and explicitly not only in communications among ourselves but in informing the public. Complexity and variety of communications have increased enormously in the last half century. Fifty years ago we had newspapers small in number of pages and circulation, and a few magazines of general circulation but not very large. The number of trade and professional periodicals was small compared with today's long lists of publications. All those outlets for information have increased enormously in the last half century and others of great size have developed—radio and television as examples.

Our own profession of engineering also has become much more varied and complex to meet the requirements of modern life—a life and civilization that has probably changed more radically in these last five decades than in any other similar period known to us.

This vast expansion has enlarged the demands on the engineering profession. It has increased the need for articulateness among engineers, for skill and facility in talking and writing—for individual awareness of that comparatively new field called semantics.

For the purpose of this discussion, I would ask how you would define an engineer. As a case in point, the dictionary defines a specialist as a person who has devoted himself to the study of a particular branch of art or science, and thereby has acquired a particular or special knowledge of the subject. The expert is defined as a person who has been taught by use, practice, and experience. The expert is the artisan. One may become an expert piano player, without ever becoming an artist.

In the progressive life of our nation, we have need of both the expert and the specialist. It is when we find the two combined in one person that we have one of the most useful of our citizens—the engineer.

One authority called engineering a science and an art which requires, among other things, skill in organizing and directing human activities.

To me, all these definitions point to the desirability, yes, the necessity, that all of us in this business be proficient in making ordinary people understand what we do, why and how we do it. That calls for short, common words, concise language, simple construction and clarity throughout, either in writing or speaking.

The worst thief of time, among a man's associates and his bosses is the fellow who takes twenty minutes of rambling discourse to tell what could be said in twenty words. There is a curious and widespread tendency among engineers to surround the answer to a simple question with so many preliminaries and commentaries that the answer itself can hardly be discerned in the verbal fog. It is so difficult to get a direct answer out of some men that their usefulness is thereby greatly diminished. The tendency is to explain the answer before answering the question.

To be sure, very few questions admit of simple answers without qualifications, but the important thing is first to state the crux of the matter as succinctly as possible. On the other hand, there are times when it is very important to add the pertinent background or relevant facts to illuminte a simple statement. The trick is to convey the maximum of significant information in the minimum time, a valuable asset to any man. We must achieve that delicate balance to assure that we are conveying a convincing explanation without being so verbose as to make it difficult for the listener or reader to get the essential facts.

An excellent guide may be found in the standard practice of newspapers in printing the news. The headlines and the lead or first paragraph give 90 per cent of the basic facts. If you have the time and interest to read further, the next paragraphs give all or most of the important particulars. Succeeding paragraphs simply give details of progressively diminishing significance. To fit an article into available space, an editor simply lops off paragraphs from the rear end, knowing that relatively little of importance will be lost.

I believe we in this profession can hardly do better than to adopt this method in our own reports and other documents, presenting facts in the order of importance, as if the narrative might be cut off any minute.

Should we not cultivate the habit of

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Lewis A. Vincent, General Manager, National Board of Fire Underwriters, gave this talk on May 21, 1953, at the Annual Meeting of the Society of Fire Protection Engineers, in Chicago.

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"boiling matters down" to their simplest terms? Of course, we must put enough into presentation to carry the point but not put so much explanation that the point is lost. The faculty for reducing apparently complicated situations to their basic, essential elements is a form of wisdom that must usually be derived from experience, but there are mixed differences between otherwise comparable individuals in this respect. Some people seem eternally disposed to "muddy the water;" or they "can never see the woods for the trees," or to use all the hackneyed words and cliches they have ever heard of, thinking, perhaps, that those generalities are good English. In fact, they are useless, worthless, meaningless words. Perhaps a man cannot correct such an innate tendency simply by taking thought, but it appears to be largely habit, a habit of withdrawing mentally to some far point in the hope of seeing a mass of facts in perspective, or a habit of becoming lost in a sea of detail. It should be our practice to integrate, condense, summarize, and simplify facts rather than to expand, ramify, complicate and disintegrate them.

Language has been called a system of signals which a speaker or writer uses to make people react in a certain way.

Therefore, successful use of language to create the desired reaction or convey information accurately is impossible unless the signals are understood in the way the speaker or writer intends.

Every profession, art, craft, or business builds up a terminology, call it "jargon," "lingo," or whatever you choose, that is necessary in that particular field.

A bridge in dentistry, for example, is a very different thing from the term as we use it in engineering, even though it does have the same meaning, that of filling a gap. The same word is used in different ways by musicians and motion picture script writers, possibly by others, too.

The word "exposure" as used by fire protection engineers, means one thing to us and another thing to the doctor who uses the same word, or to the photographer or to the policeman who makes an arrest for indecency.

A sentence is one thing to an English teacher and another thing to a judge or a criminal.

A whole game could be played for hours, if we wanted to pick words that are spelled in the same way, usually pronounced the same way, but carry entirely different meanings among different communities of people.

I can cite these instances to make the point that all of us have to be watchful all the time to make certain that we do not let undecipherable professional lingo get into the talks of written pieces that are intended to inform the public outside our business.

Certainly that calls for simple words and simple sentence structure. Misunderstanding by a listener or reader may be based not so much on the definable meaning of a word but on certain less distinct elements that are usually called "connotations."

Short, simple, homely words certainly are less open to misunderstanding or numerous connotations than unusual words that are little known even to those who consult dictionaries habitually.

Meanings are frequently misunderstood because the speaker or writer, and his audience, may belong to different speech communities. The audience may

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A Date to Remember

Aug. 15

At Chevy Chase Country Club

WSE'S 4th Annual Golf Tournament

(Details on Page 2)

Transistors and their Applications

By Robert P. Dimmer

In 1907 a young American electrical engineer named DeForest discovered that if he placed a wire connected to a battery in the path of a stream of electrons in a vacuum tube, he could control the flow of these electrons by varying the voltage from the battery. By this simple technique he was able to interrupt, reduce, or stop entirely the electron flow between the negatively charged filament and the positively charged anode. If he placed a feeble voltage on the input of this device, he found that he could get a much greater voltage at the output. This comparatively simple finding was the basis for DeForest's "audion" vacuum tube which gave such impetus to the huge modern electronic industry as we know it today, with its radio, television, radar, guided missiles, etc. Little could we predict then that it would eventually involve the production of nearly a half a billion radio tubes yearly.

In 1948 a similar occurrence happened. About that time a small group of scientists at the Bell Telephone Laboratory, under the direction of J. Bardeen and W. Brattain, brought to light another profound and simple finding which may rank in importance with that of DeForest's. In essence it is a method of controlling the flow of electrons in a solid crystal of matter instead of in a vacuum. Although this device or transistor, as we call it, is comparatively young, the concept of controlling the flow of electrons or carriers in a solid is as old as the radio art. In the latter part of the last century it was known that certain solid materials, galena—for example, offered great resistance to the flow of current in one direction, but permitted the current to flow in the opposite direction. A little later the crystal detector emerged to be used for some years after. With the advent of DeForest's Audion, the crystal detector took a back seat only to be revived in a slightly different version for use in radar equipment during World War II.

After considerable study by some of our top scientists in universities and laboratories throughout the country on the true nature of semi-conductor materials and particularly germanium, the first transistor was announced in 1948. This device was called a point-contact transistor because it was built around a block of germanium with two points (wires) or "cat's whiskers" in contact with the germanium. The characteristics of these first units varied considerably, but as is usual with a new device, many of the production difficulties were eventually surmounted giving us today a fairly reproducible transistor.

During their work on the point-contact transistor, some researchers considered a multi-contact unit where many points or surfaces would be in contact with each other. This idea led to a second type of transistor, the junction transistor, which was made public a little over two years ago. In this type of transistor two types of a semi-conductor material such as germanium are in contact with each other over a comparatively larger area than in the point-contact type. With a larger area to contact, it can be expected that a junction transistor will be capable of doing more work. Due to several advantages over its predecessor, the point-contact type, it appears that the junction transistor will be used in over 80 per cent of the cases where this device is considered.

In order to make a transistor of either type presently used we must start with a very pure piece of the semi-conductor material, germanium. To determine this purity it is necessary to substitute electronic means for the less sensitive chemical analysis techniques. One part impurity in 10 million parts of germanium is still not pure enough; one part in 1 billion parts is usually too pure. The piece of germanium with this purity is not found in nature as such; therefore, it must be fashioned by man before it will work for him at his bidding.

Winkler, a German chemist, first isolated this rare metal from the mineral Argyrodite in 1886; Mendelyeev, in propounding his periodic table in 1871 had predicted the discovery of this metal.

A large number of minerals have a trace of germanium but there is no single rich source. The chief American source has been the stacks of the zinc smelters of Kansas, Missouri, and Oklahoma. A great reserve is in coal ash, particularly in England where the germanium content is quite high. Coals in the Kettanning seam in Ohio and recently a coal from Pennsylvania were revealed to have a useful percentage of this metal in their ash.

Extracting germanium from the ash is a very difficult job; therefore most electronic firms buy the dioxide at about $140.00 a pound. It is rather interesting to note that only ten years ago, germanium was worth $4,500.00 a pound, or nearly 9 times the price of gold. At that time the supply of this rare metal in this country was under 10 pounds. Today the price is approximately $317.00 a pound for the pure metal.

In order to obtain the purity required, it is necessary for the transistor manufacturer to purify the metal further in a special furnace. By heating the metal from one end to the other, the impurities which prefer the molten liquid to the solidified state can be swept to one end of the metal.

The pure germanium now must be doped in a controlled process to give it the type impurity required, and made into a single crystal. A small single crystal, a "seed," which was previously made by this or another method, is lowered until it comes into contact with the molten germanium and slowly raised. At the same time the source of heat for the molten container is slowly lowered. By using

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Robert P. Dimmer, Project Engineer, Automatic Electric Company, Chicago, presented this talk before the Western Society of Engineers on April 1, 1953.

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the proper lifting speed for the seed and lowering speed for the heat source, the germanium freezes to the seed, and after a couple of hours withdrawal it forms a long single crystal. While the germanium crystal is being pulled, pellets of impurities are added to the melt to make the type of germanium desired. Pellets of arsenic would make "n" (negative) type germanium, and aluminum would make "p" (positive) type germanium. "N" type germanium would have an excess of negative charged particles—electrons; "p" type would have an excess of positively charged particles—holes. The single crystal of germanium is then tested for its resistivity and the lifetime of its carriers, a criterion for its transistor action. The tested crystal, which resembles a carrot in shape, is sawed in discs, and finally in small pieces approximately 1/16" in size for use directly in transistors. With this wafer we are now able to construct a point contact transistor. The piece of germanium is usually soft soldered to a comparatively larger piece of non-reactive metal. When assembled, the two whisker points, the emitter and collector, are held in place separated by approximately .002 inches and pressed down on the top of the piece of germanium. These points are then molded in place.

There are two methods of making junction transistors; crystal growing, and diffusion technique. In the crystal growing method the germanium is doped to produce a narrow layer of the type of impurity desired while it is pulled as a single crystal. In the diffusion method, a piece of germanium of one type of conductivity has melted on its opposite faces, a metal of the opposite type impurity.

In discussing the operation of a point contact transistor, let us consider a unit which has n-type germanium. In this case the emitter injects holes into the germanium which drifts across the tiny distance to the collector, attracted by its negative voltage. Holes are the spaces left when an electron leaves the outer shell of an atom. The movement of these spaces or holes can conduct a current in the crystal in very much the same way that we speak of electrons conducting a current in a wire, and are usually called positive carriers. These significantly lower the resistance of the germanium immediately around the point where the collector makes contact. This action in the point contact transistor is not too well understood, although it appears as if these holes served to open trap doors to allow electrons to pour through.

For illustrative purposes let us assume a signal of one million holes is impressed on the emitter; these holes will act on the collector point to allow 3.5 million electrons to flow through the collector circuit. One million of these electrons will drop into the million holes to make neutral atoms; the other 2.5 million will constitute the collector current, and in this case will represent a current gain of 2.5. Considerably greater power gain is possible in the collector circuit because the collector contact offers greater resistance to the flow of current, and the work done to overcome this resistance is that much greater. This extra energy might be represented by a dam next to a full reservoir of water. A slight ripple in the water of the reservoir will cause a small amount to topple over the dam. When this small amount of water reaches the bottom of the opposite side of the dam it has considerable force and represents a gain in energy. As amplifiers, point contact transistors can boost a signal 100 times. If some of their output is returned back to the input, the units can be made to oscillate.

The junction transistor is quite different in its operation and construction, although its action is based on the same semi-conductor properties of germanium. In an n-p-n junction transistor a thin layer of p-type germanium is sandwiched between two n-type pieces or zones of germanium. The outside n regions act as the input-emitter and output-collector; whereas the middle layer acts as the base or common terminal. In the operation of an n-p-n transistor, for example, electrons are injected into the germanium and flow through the thin center layer to the collector, which has a positive voltage applied to it to pull the electrons through. In a p-n-p type of junction transistor the polarity of the voltages applied are reversed, and holes are injected into the emitter instead of electrons; otherwise the operation is similar. A signal applied to the emitter or base in either case determines the quantity of electrons or holes sent to the collector region. These carriers flowing through the junctions at any instant provide the control action for current flow in the collector circuit.

Junction transistors are more stable as amplifiers than point contact transistors, and have less noise. They are able to operate with lower voltages than the point contact transistors, and a signal can be boosted several hundred times more than with the point contact type. Except in switching and certain other minor applications it appears that junction transistors will be used more extensively than the point-contact type.

In essence a transistor can do what most radio tubes do. But there is a difference in how this work is done; an electron tube controls electrons in a vacuum, a transistor controls electrons or their opposite, holes, in a solid. Since a transistor can control either positive or negative carriers, it gives us another new medium of control. One important attribute of this dual role is what is called complementary symmetry. By this circuit technique we can furnish sufficient energy to feed a loudspeaker with an audio amplifier consisting of only two p-n-p and two n-p-n transistors. The vacuum tube equivalent to this amplifier would require two or three tubes, several capacitors, resistors, and at least one transformer together with power supply several times the size of the transistor power source.

One of the first and most ideally suited uses for transistors is in the hearing aid field. Some manufacturers have already placed on the market units incorporating 3 or 4 transistors, and operating on a single small battery. These units have the same output characteristics as the older vacuum tube models, and give batteries many times greater life. As a result, the maintenance cost is reduced, and because of the use of a single battery, the

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WSE's Dining Room

will be closed during June, July and August, due to the construction necessary for the Society's expansion program. The Dining Room will reopen early in September.

Welding Sequences

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discuss what to do about it. A first rule is to make sure there is enough material. Trimming to size should be done after welding is completed. In laying out the work for location of stiffeners, connections, etc., there should be allowance for the expected shrinkage. (This involves the same principle as a pattern maker's shrink rule.) Accurate fitting will minimize shrinkage at joints. Careless fitting can double or tripple the shrinkage in individual joints and it can add an appreciable amount to the overall shrinkage of a welded part or structure.

In actual welding, the greatest aid to restraint of distortion is adequate tack welding and its corollary, block welding. Clamping the work to a strong-back or a bed plate reduces weld distortions, but does not eliminate them. Occasionally pieces to be welded can be reverse cambered by an amount equal to the distortion expected to result from the welding so that they will be in proper shape when welding is completed and the cambering clamps released.

While considering the control of welding distortions it should be recognized that welding to attain specific shape and dimensions is bound to involve some restraint and that it will consequently result in a certain amount of residual stress. Welding designed to leave a minimum of residual stress in the finished part ordinarily does not lead to maintenance of specified dimensions and shape. When such a part is finally straightened, it is very likely to have as much internal stress as a piece that is welded in a manner that maintains the required shape and dimensions. This is a pitfall often overlooked in the development of welding procedures.

A rather time-worn rule in welding is "weld from the center, progressing symmetrically in both directions." The origin of this rule lies in gas and bare wire arc welding work and it pre-supposes either inadequate tack welding or none at all. Actually, it is often desirable or even necessary to begin at the ends, or even at the ends and one or more interior points, in welding extensive joints or structures.

Girder flanges welded to their web plates by automatic welding are almost always welded from end to end of the girder. Bridge floors, bin walls and long lines of framing for buildings are usually welded from several starting points. They have to be in order to meet completion schedules. Of course, there has to be careful allowance for shrinkage in such work. A floor cannot be completely placed in final position and then welded. Neither can a long building frame be fully plumbed before it is welded. Accumulation of shrinkage could pull the columns seriously out of plumb.

Sometimes a "panel" sequence of welding is necessary in large structures to allow welding to keep pace with steel raising or to meet schedule requirements. In this scheme, units of the structure are treated as separate entities until their welding is completed. The units are then connected with welds that may have some restraint but which can with care be made successfully and without undue difficulty.

In repetitive production of machinery it has often been possible to develop very precise and also elaborate welding procedures and sequences that keep distortion from welding amazingly small. These are the result of the detailed analysis that can be given to repetitive production work and the trial and error experience that is possible in such work.

Civil engineering structures, in contrast, are mostly of the "one of a kind" variety. Welding procedures and sequences for them must, in consequence, be more elemental and must allow for ordinary construction intelligence to fill in details. It is usually sufficient to recognize that butt welds must be made before the parts being connected are attached to other parts that would restrain their shrinkage across the weld. The segments of a girder flange, for example, and also the web plates, are butt-welded together before the flanges are assembled with the web to make the girder. In compound joints, such as the butt welding of a rolled beam or column or the splice of a girder, the weaker or thinner section, usually the web, should be welded first. It will not then be overstressed or ruptured by shrinking against the restraint of welds in the thicker elements of the joint.

The best rule for making individual welds is to use "scatter sequence" and to bring part or all of the welds promptly to size. This is accomplished automatically in single pass welds and without special attention in short multi-pass welds. In long multi-pass welds, especially butt welds made manually with a large number of small passes, it is often desirable to use block welding. This is a procedure in which segments of the weld 6 to 12 or 15 inches long and 2 to 4 feet apart are built to full size or nearly full size before intervening portions of the weld are made. The blocks in themselves develop

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only a small part of the shrinkage of the whole weld and, after they are made, resist the shrinkage of the remaining portion of the weld.

There are many other tricks and schemes for avoiding, controlling and out-guessing the effects of welding—every shop has its own—but this discussion that started with the axiom "Welding always causes shrinkage," provides a few tools with which the problem can be attacked, and it may make it easier to understand the effects of welding.

Uses of Localized Heating

It is only a step from trying to outwit the shrinkage of welding to trying to make the same phenomena work usefully in the fabrication of steel structures. This is perhaps a "hair of the dog" proposition, but there is precedent for it in the ancient arts of the blacksmith and shipwright. They have long used localized heating without the application of force to straighten iron and steel parts and to form them.

When the shrinkage of localized heating is to be used constructively for either straightening or forming structural steel, the heat is usually applied with an oxy-gas or oxy-acetylene heating torch which delivers an intensely hot flame from a tip one inch or less in diameter. Heating is usually along lines, but it is sometimes concentrated in spots. Occasionally fairly large areas are heated.

The temperatures used ordinarily are in the range between a black heat of 700°F and a dull red heat of 1200 to 1250°F. Temperatures below 700°F are only mildly effective in producing change of shape. Temperatures a little above 1250°F are in the transformation range of structural steel and are usually avoided for metallurgical reasons. Occasionally, temperatures of 1500° to 1600°F, which are above the transformation range, are used, but ordinarily some other means of straightening or forming is preferable to the use of localized heating at such temperatures.

Parts that have been distorted by the shrinkage that accompanies welding are straightened by heating along a line or lines parallel to the welds, but on the opposite side of the part or member. A girder flange curled toward the web by weld shrinkage is straightened by heating the outside of the flange along its centerline. A channel bowed by welding along one flange is straightened by heating along the other flange.

Plates or sections of plates that are bowed or buckled by welding around their periphery can be flattened by heating spots in checkerboard arrangement outward from the center of the buckle. This has been a very necessary process in ship building where plates buckled by welding shrinkage must be made fair. In structural work it is occasionally used for making the webs of girders flat.

Structural members that are bent or distorted by accident or rough handling in the course of erection can often be straightened by use of localized heating, but there are no set rules for accomplishing the work, especially if the member is of riveted construction and has multiple thicknesses of steel in its various elements. Heating of such members is usu-

ally limited to 1200°F and care has to be exercised to avoid application of heat that will allow one thickness of steel to expand and shrink against another that has not been heated. The outstanding leg of a flange angle of a girder with a heavy cover plate, for example, must not be heated without also heating the cover plate equally. If it is heated without heating the cover plate, it may pull itself in two when it cools against the restraint of the cover plate. When there are three or more thicknesses of material, heat can be applied only from the edge. If the heat were applied on the surface of the outer plates, there would be no way of putting as much heat into the interior thickness as would enter the outer material because the interfaces between the parts are barriers to the flow of heat.

These conditions and restrictions were all encountered in a job of straightening a 123-foot span skew girder bridge that, because of rough handling, had an S shaped lateral deflection of as much as 2 inches after it was erected. Except for one or two places beyond the end of the bottom chord cover plate, heating had to be along the edge of the flange because there were two cover plates on the flange angles. Heating first at the worst kinks and then along the long sweeps made the girders straight within 3/4 inch in their whole length.

Another "rescue" job involved straightening a 120-foot long steel pile made of a butt welded 14 WF section with a pair of 15 x 3/8 inch cover plates welded across the toes of the flanges for a length of 85 feet in the middle of the pile. The piece was kinked and bent to a sweep of 9 inches maximum ordinate in unloading it from the freight cars on which it was delivered. Heating V-shaped areas across half the width of the flanges, and simultaneously heating across the cover plates where they extended into the kinked region, took out the sharp bends. Longitudinal heating of six lines along the cover plate removed the intervening curvature. A crew of two men working under skilled supervision with only man power to roll the piece over, made it straight within 3/4 inch in the length of 120 feet in less than a day.

The greatest shop use of "heat forming" at present is in cambering rolled-steel beams. The rolling mills can furnish cambered beams, but the minimum or maximum camber the offer, or the tolerance they demand, often fails to meet designer's requirements. Fabricating shops do not have presses capable of bending large beams and they consequently resort to the application of localized heat to create the cambers that are required. The beams are placed upside down and are supported only at their ends. In early work of this sort, strips 3 to 6 inches wide extending across the flange were heated red hot. The restraint of the web and the weight of the beam upset the heated metal so that it was shorter after it was cooled. Sometimes the heating was carried into the web in a V shape extending to the middle of the beam or even to the far flange of the beam. Both of these schemes, however, produce a "chorded" camber that consists of straight lengths of beam between sharp kinks.

A scheme of heating the flange longitudinally has now been developed to make the operation more efficient and to provide smoothly curved camber. In this procedure the torches, usually three, are mounted on a tractor carriage like those used for flame cutting. The torches are carried over the length to be cambered at a speed that will develop a temperature of 700 to 900°F immediately behind the torches. The strip of metal under the torches expands against the restraint of the adjacent unheated steel and it and the flange are consequently shorter after cooling. This shortening of the flange causes the beam to be cambered.

The pattern of residual stress is one of tension in the zones that were heated, and compression in the flange edges, the strips betwen the heated zones and in the web immediately adjacent to the flange. This is in contrast to the residual tension that exists in all of the corresponding flange and adjacent web of a beam that is cambered an equal amount in a press.

This discussion of uses of heat for straightening and forming steel has not attempted to be a quantitative one because the use of localized heat is still somewhat of an art. The internal stresses in the piece are never known prior to the start of the work and the workman must judge both the state of stress and the effectiveness of the heating by the amount that the piece moves in a direction opposite to that in which final movement is desired. A piece that is to be made concave becomes convex when it is heated and does not appear concave until it is cooled. The final displacement is always "away from the heat." This rule makes a good closure for the discussion because it is the starting point for anyone who wishes to try to use localized heating for straightening or forming structural steel.

I.I.T., Liberal Arts, Offer Joint Degrees

Illinois Wesleyan university, Bloomington, Ill., and St. Mary's college, Winona, Minn., have joined with Illinois Institute of Technology in offering a combined educational program in liberal arts and engineering, it was announced in Chicago.

Under the program students receive a double-barreled education; they earn degrees in both liberal arts and engineering at the same time.

Addition of the combined program at Illinois Wesleyan and St. Mary's brings to 17 the number of schools participating with I.I.T. in this educational plan. The program works like this:

Students attend Illinois Wesleyan, St. Mary's or one of the other cooperating schools for three years, then spend two years at Illinois Tech. Upon completion of the five-year program, they receive a bachelor of arts degree from one of the former schools and a bachelor of science degree in a field of engineering from I.I.T.

Dr. John Day Larkin, dean of liberal studies at Illinois Tech, explained that the combined program was developed to help meet the country's need for trained engineers with a background of general knowledge. The program enables students to obtain a wide background in the humanities before specializing, he said.

Besides Illinois Wesleyan and St. Mary's, the following colleges and universities cooperate with Illinois Tech in offering the combined program:

Aurora college, Aurora, Ill.; Carroll college, Waukesha, Wis.; Carthage college, Carthage, Ill.; Centre College of Kentucky, Danville, Ky.; Coe college, Cedar Rapids, Iowa; Hamline university, St. Paul, Minn.; Heidelberg college, Tiffin, Ohio; Hiram college, Hiram, Ohio; Illinois college, Jacksonville, Ill.

Lake Forest college, Lake Forest, Ill.; Macalester college, St. Paul, Minn.; Muskingum college, New Concord, Ohio; North Central college, Npaerville, Ill.; Roosevelt college, Chicago; and Westminster college, Fulton, Mo.

Words

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be familiar with the sound of the words but not with the finer shades of their meaning.

In baseball, in the vicinity of Ebbett's Field in Brooklyn, the word "bum" is used as a term of approbation or at least toleration, but none of us would advise any visiting foreigner to use it as a term of friendliness in a Third Avenue bar in Manhattan.

There is no ideal language in which each word has a single unmistakable meaning, and in which one idea can be expressed by just one significant word.

Sometimes it's not only the words that cause fog, but the wind is used to hold them together. You remember when Maury Maverick of Texas invented the new word "gobbledygook," a few years ago in his article in the New York Times Sunday Magazine about hifalutin English. Occasionally you see "gobbledygook" today, not always with that headline over it, either. Sometimes some of it gets into our own reports and other documents.

We have all heard the historical words of Lord Nelson, "England expects every man to do his duty." They saw that a former Member of Parliament, A. P. Herbert, attacked verbosity once by changing these very concise and effective words into what we might call "officialese," saying: "England anticipates that, as regards the current emergency, personnel will face up to the issues and exercise appropriately the functions allocated to their respective occupation groups."

It has been remarked by some who have viewed our profession objectively that many of us are short in persuasiveness, in the art of convincing or persuading others, and particularly outsiders, that our view of facts and figures is correct. We may know the truth—that is, the facts and figures—but we are not always adept at interpreting them for others. You recall the anecdote about Mark Twain, a swearing man, and his gentle wife. When Mark's collar button fell on the floor and rolled away his language was pretty bad. He didn't know his wife was within hearing. Then he heard her repeating his exact words.

"Livy," he said, "you got the words all right, but you don't know the music."

Sometimes that's true of us. We know the facts but we can't play the tune. Maybe the answer is to be found in making up our minds to learn the music and then to practice it.

The poet and playwright—Edward Bulwer Lytton—who said that "the pen is mightier than the sword," was expressing in his own way an idea that had been kicked around for centuries. The pen of iron is mentioned in Isaiah in the Old Testament. Cervantes in *Don Quixote* expressed his preference for the sword over the pen.

But the pen is winning out in these modern times. How can you build an atomic bomb or any modern weapon, or a modern vehicle or structure for peacetime use, without the draftsman's pen on the drawing board, or without mathematics and its symbols? It is impossible. Useful as words are in communication and understanding, no man, however skilled, could build a Brooklyn Bridge without plans and specifications. That truth applies equally well to the work of the fire protection engineer. His work with the pen, at the drawing board and in carrying the message of fire prevention is the best way to plan and build for fire safe communities.

A skilled writer, Stuart Chase, many years ago wrote a book called *The Tyranny of Words*. He pointed out how carefully and studiously they have to be used to plant an exact meaning in another mind—and the speaker or writer can never be sure that a word will not grow where he had hoped to see a flower.

Mr. Chase then goes on to imply that if users of words, and not engineers alone, could carry on with precision and predictability (such as what will happen when steel, stone and chemicals are combined) in their field, a great advance could be made in the art of communications.

We, as fire protection engineers, must not fail in our responsibility to do our job properly. I am certain that we honestly stand and defend the work we are doing as engineers. Facts support the view that real progress has been made and is continuing to be made in the fight against destruction of lives and property by fire.

It is important, however, that we make effective use of the means available to convince others that this war against waste is one in which every man, woman and child should participate for his own good. It is not a job that can be done by a comparatively few experts, specialists and engineers alone. It should be part of a people's crusade for safety—for the welfare of all.

Generator on Train Called Most Powerful

The new 2,400 horsepower diesel electric locomotive, *Train Master*, which was in Chicago on display for the first time on May 18 by Fairbanks, Morse & Co., features the most powerful single generator ever built for railroad use.

According to L. A. Spangler, northwestern district transportation manager of Westinghouse Electric Corporation, the manufacturer of the locomotive's propulsion equipment, the generator produces 1,660 kilowatts of power, or enough to meet the electrical needs of a community the size of Barrington, Ill.

The locomotive is the world's most powerful single-engine diesel. It is considered the most useful diesel electric locomotive ever built, having the capacity to meet heavy-duty requirements.

The electrical propulsion equipment built by Westinghouse for the Fairbanks-Morse *Train Master* includes the generator, the traction motors, the exciter-auxiliary generator, and the electrical control equipment.

Interesting features of the propulsion equipment include the use of silicone insulation to allow extremely high operational temperatures; the use of silver alloy brazed commutator risers instead of soldered ones to withstand higher temperatures; and sealed armature bearings in the traction motors which eliminate periodic lubrication and thus greatly reduce the possibility of failure. These and other advantages of the propulsion equipment increase the powerful locomotive's efficiency and decrease its maintenance.

Another outstanding feature of the *Train Master* is its use of dynamic braking. The Westinghouse electrical equipment controls dynamic braking by reversing the function of the traction motors and retarding the locomotive instead of accelerating it. This helps assure unfailing braking and saves wheel and brake shoe wear.

Transistors

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units can be lighter in weight. When transistors become more available, their price will undoubtedly be reduced, allowing more people to enjoy their benefits. The popular joke nowadays is that instead of replacing batteries in a hearing aid, now it is necessary to replace the transistors first.

Another important application is in the auto radio field. The power economy available using transistors had made this type of radio appear promising. Present auto radios require a heavy power supply to furnish the required power to operate the radio tubes. By using transistors it is possible to design a set where the 6 volt battery is the only power required. No step-up in voltage would be required. In fact, the power needed to run a radio of this type would be no greater than that required to operate the radio set's two pilot lights.

A Dick Tracy transceiver built the size of a wrist watch is an actual reality with the use of transistors. Besides its uses in these applications, transistors can be used in oscillators, counting circuits, switching or trigger circuits, control devices, in fact, almost any place an electronic tube can be used, except perhaps as a picture tube in a television set. Like the electronic tube which developed from early diodes and triodes into a variety of forms to serve ever-widening applications, transistors can be expected to develop in their own way into a diversity of applications.

In order to purposely evaluate the future of the transistors, it might be well to cover the advantages and limitations of these unique devices.

Advantages:

(a) *Size*:

Most germanium crystals used in transistors are 1/16″ in size; therefore, it is obvious that size is one of its most important advantages.

(b) *Life*:

We cannot say how long they will last, but from our present experience we feel that they will eventually have a life far in excess of that of the best of tubes.

(c) *Power Consumption*:

Their power consumption is negligible —they have no filament to heat. Their power needs are only a small fraction of what tubes require. This means radical savings in weight and size of batteries particularly in portable equipment. With no filament and extremely high efficiency means negligible heat output.

(d) *Warm Up Period*:

Since they have no cathodes or filaments to warm up, they begin to operate the moment they are energized.

(e) *Ruggedness*:

Transistors are made of a solid piece of metal encased in a body of plastic — no glass or floating parts to make them fragile.

(f) *Versatility*:

Certain types can control positive charges (holes) whereas other types can handle negative charges (electrons). This double action allows more versatility in circuit design.

(g) *Light Sensitivity*:

Without its dark enclosure the transistor junction is sensitive to light; therefore, they can be used as photocells.

Limitations:

(a) *Frequency Response*:

The present transistor is not too satisfactory above 10 mc. With a different design, however, some have been made that could operate as high as 300 mc.

(b) *Power Output*:

At this stage of development only a few power transistors are available which will give a watt or so in power output.

(c) *Noise*:

The noise of a transistor is somewhat higher than that of a vacuum tube; particularly the point-contact type. The n-p-n junction type has perhaps the lowest noise figure.

(d) *Temperature Limits*:

At the present time the ambient temperature limitation of transistors is around 80 to 100 degrees centigrade.

(e) *Humidity*:

It has been recently found that humidity is perhaps the worst enemy of transistors. Even when transistors are encased in plastic, they are sometimes affected. It appears likely that transistors of the future will either be sealed hermetically or some other technique will be used to prevent moisture absorption.

Bjorksten Research Starts New Building

Dr. Johan Bjorksten, MWSE, President of Bjorksten Research Laboratories, Inc., announced June 8 in Madison, Wis., that ground has been broken for a new laboratory building on the firm's 168 acre Fish Hatchery Road property. Completion of the three story building is scheduled for October of this year. It will contain 15,000 square feet of laboratory space in addition to the four smaller buildings already in use.

Work in the new laboratory building will consist largely of research in the plastics and polymer field. Facilities for organic synthesis, and supplementary radiotracer facilities, will also be provided.

Bjorksten Research Laboratories, Inc. also maintains laboratory facilities in Chicago, offices in New York City and in Houston, Texas, and a literature branch in Washington, D. C.

General contractor is John H. Findorff and Son, Inc. of Madison, Wisconsin.

On Training—

Letters from Leaders

In the last issue of Midwest Engineer we published another of about thirty letters received from leaders of Chicago-area firms concerning shortcomings noted in the engineers in their employ. Many of the letters also suggested what the engineers should do to correct their deficiencies.

Significantly, the engineer's technical training is generally considered adequate. In the broad area of Human Relations, however, engineers seem often to be "under achievers," according to the viewpoint of the industrial leaders as reflected in their letters.

We are printing another of these letters in this issue, as we shall do in future issues. Although the letters may be of greatest value to the younger engineers, we hope that all of the engineers who read them will benefit.

Here, then, is the next letter:

My dear Mr. Becker:

I have read with interest, in your letter of August 31st, of your current program to assist your members in better preparing themselves to meet the requirements of top engineering and executive positions.

As you undoubtedly know, Mr. , Vice President of our Company with overall supervision of our engineering activities, has for many years been directly concerned with this subject, not only within the Company but throughout industry. In my opinion, he is in best position to give you such a statement as you have in mind, and I am handing your letter to him for his consideration.

Dear Mr. Becker:

As noted in his letter of September 7, Mr. , President of our Company, has turned over to me your letter of August 31 to him. In it you ask as to our views on deficiencies we see in engineers today.

As a general rule, engineers coming from the recognized technical colleges today are quite competent in technical matters. We do feel that there is a tendency in the technical schools to put too much emphasis on specialized education. Some of this specialization may be justified for the very small industries, but as for our company we would prefer greater emphasis on fundamentals and less on specialization.

Another way of expressing the same viewpoint is to say that we do not want the colleges to attempt to turn out a finished turbine designer. We do want training in mathematics, mechanics, thermodynamics, etc. but when it comes to teaching the budding engineer how to actually design a turbine, we would rather do that ourselves than to have the college attempt to do it. If the college does try to do it, the young engineer may have to "unlearn" quite a lot.

But, as I intimated at the outset, the occasion when we have to dispense with a man's services because of his technical incompetence is extremely rare.

Most of the deficiencies which we find in young engineers today are in the nature of what might be termed personal characteristics, such as a lack of ability to co-operate and get along with other people; a lack of an adequate sense of responsibility and recognition of authority; an unwillingness to seek help from others; a desire to do a job all on his own, which is laudable under some circumstances but not apt to produce best results in working in an organization; too intense ambition, which may lead him to spend so much time worrying about and trying to get ahead that he does not give adequate attention to his real job; lack of consideration for the viewpoint of others, or inability to get this viewpoint; inadequate ability to express himself, either orally or in writing; lack of a sense of proportion, resulting in unwarranted effort on certain parts of his activities.

I would go on with this list and perhaps make you feel that the colleges today are turning out a very poor product, but I think this is not the case. One or more of these deficiencies that I have cited above, and others which might be thought of, do exist in numbers of technical college graduates, but usually they are offset by other good qualities so that the net result is on the whole very good.

I feel that the product of the colleges is improving and that the young engineer coming out of school today is much better prepared for his life work than was the graduate of ten or fifteen years ago.

Review Signal System of N. J. Turnpike

The complex communications system on the New Jersey Turnpike, where police and other personnel keep more than 18,000,000 vehicles moving annually, was described in Atlantic City, N. J. on June 19 before the nation's electrical engineers, many of whom had a hand in developing the electronic wonders that make such communications system possible.

The description of the radio, telephone and teletype system was particularly pertinent as many who heard it during the Summer General Meeting of the American Institute of Electrical Engineers at the Chalfonte-Haddon Hall Hotel had arrived by auto, using the famed turnpike for the first time.

P. F. Godley, of the Paul Godley Company, Great Notch, N. J., whose company developed some of the unique features of the system, and J. R. Neubauer and D. R. Marsh, of Radio Corporation of America, reviewed the system in a paper entitled "The New Jersey Turnpike —

a Unique Highway Communication System."

To keep traffic moving on this $285,000,000 stretch of highway that knifes through New Jersey from the Delaware River to the George Washington Bridge, police, Turnpike administration personnel, highway maintenance men, customer service stations, and entrance and exit personnel, utilize five very high frequency radio stations, seven microwave stations, 75 mobile units and 86 toll booths at the 17 interchange stations on the present 118 miles of highway.

Many complex and novel problems were solved before satisfactory communications could be established, as the Turnpike lies in the shadow of two great broadcasting centers, New York and Philadelphia, where the atmosphere is filled with hundreds of broadcasting signals from police, commercial and broadcasting sources, they said.

Among the problems solved by the Godley Company was that involving mobile units in a mid-zone between two simultaneously operating co-channel stations.

"Here, even though both carry the same speech modulation," they said, "interference is developed by phase differences in the audio frequency components of the two carriers.

"A novel 2-element, directive, car-top antenna was devised wherein one element is driven, the other parasitic. A 5 to 1 front-to-back field ratio is had. Reversal of the field pattern is brought about via a feed-line switching relay actuated, in turn, by a toggle switch on the dash-mounted control plate. Thereupon the parasite is driven, and vice versa.

"With, say, 25 mile spacing of relay stations, the effects of antenna pattern reversal is about the same as that had were the vehicle instantaneously lifted to a point some 4 miles up or down the highway, depending upon whether the switch is in either the "fore" or "aft" position. The interference area is thus erased.

"This antenna also served an important economic purpose. It made possible the use of 10 watt, mobile transmitters which could be powered without costly amplification of standard battery-generator car equipment."

Cost of the communications system, they said, was less than one per cent of the entire outlay for the Turnpike.

Balance Seen in Timber Use

The growth of timber in relation to the annual cut in the United States is slowly swinging toward a balance which should insure a permanent lumber industry, thanks to new methods of harvesting and manufacturing with respect for sustained-yield stability. This was brought out in an address by Frederick F. Wangaard, professor of forest products, Yale School of Forestry, at the 1952 meeting of the American Society of Mechanical Engineers in Chicago.

"The total stand of sawtimber in the United States, which originally exceeded 5,000 billion board feet, is now 1,600 billion board feet. Yearly growth, computed on the basis of cubic feet to provide a common measure for the various forms of use of trees down to five inches in diameter, is estimated at 13.4 billion cubic feet. The total annual drain, in the same terms, is 13.7 billion cubic feet—a deficit of only two percent," he said. "An encouraging fact is that the current rate of replacement through growth is more than twice that estimated in 1920.

"These statistics do not show the irregularity of surpluses and deficits by regions or species, nor do they reveal the balance situation with respect to timber of sawlog size," he added. "Sawtimber growth is estimated at 35 billion board feet per year, nearly three times the 1920 growth. But total sawtimber drain, including the cut for lumber and other products, as well as losses by fire, insects, and decay, amounts to 54 billion board feet, leaving 19 billion board feet per year to be taken from capital. This represents an excess of drain over growth of 50 percent, a statement that should be examined in the light of earlier surveys of 1920 and 1933 that placed drain of sawtimber at five times the rate of growth. As more young second-growth stands grow to measurable size and as more now-growing mature timber stands are harvested and converted into young stands of second growth, the balance will continue to swing toward equilibrium between growth and drain, and the industry will have completed its transition to sustained-yield stability."

The gross value of all timber products in recent years is estimated to exceed 15 billion dollars annually, while that of the products of primary manufacture alone, such as lumber, plywood and wood pulp, is estimated at 4.2 billion dollars. A 1946 study estimated that 3,300,000 persons (six percent of the nation's paid workers) were productively employed in business directly traceable to the timber resource of the nation, he said. There are about 60,000 sawmills, 650 veneer and plywood plants, and 200 to 250 pulp mills in the United States today, and at least 92,000 manufacturing plants use wood in their product, in the process of making their product, or in making containers in which to ship their product.

"Two-thirds of current lumber production is used in construction. There are some 40 million residential structures in the United States and about one million new units are being built each year. Nearly 90 per cent of these have a lumber framework, three out of four have wood exteriors, and wood is used in the great majority of homes for flooring and interior finish. Nearly 95 per cent of seven million farm dwellings in the country are built of wood. The construction of new farm buildings, together with the demands for maintenance and repair of old buildings, consumes over four billion board feet of lumber each year.

"Non-residential construction including commercial and industrial buildings, schools, hospitals, churches, utilities, public buildings, and the construc-

(Continued on Page 18)

Continued from Page 17)

tion of highways and bridges consume even more lumber than the farmer. Each year the Class I railroads of the country use a billion board feet of sawed cross-ties and bridge ties, virtually all preservative-treated for long life," he revealed along with the fact that wood is second only to steel as a structural material used in building and maintaining our nation's naval forces both on shore and at sea.

"In 1948 the total amount of wood used in manufactures was 13.7 billion board feet, 89 per cent of which was in the form of lumber, eight per cent veneer and plywood and three per cents as bolts. The remanufacture of lumber into finished products constitutes the second greatest outlet for the product of the sawmill (exceeded only by construction), and these same remanufacturing industries are also major consumers of veneer and plywood.

"Among five major uses of wood are containers, 34 per cent; millwork, 16 per cent; flooring, eight per cent; and railroad car construction and repair, three per cent."

A listing of a few products such as agricultural implements, shoe lasts, matches, pallets, patterns, ladders and pencils emphasizes the ways in which wood is a part of our very existence today, he said.

Seek Industrial Uses for Ancient Flavoring

Licorice, which for more than 40 centuries has tickled mankind's sweet tooth, now is engaging the attention of American business and industry for application in products as diversified as tooth paste and electro-plating solutions, a flotation agent for separating ore from waste and an ingredient for rubber.

More than 100 firms in fourteen different fields are looking to licorice and its derivatives for improved and new products and processes. They include some of the country's foremost business organizations, William W. Walker, president of MacAndrews & Forbes Company, world's largest manufacturers of licorice products, revealed recently.

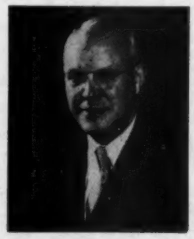
Mr. Walker noted that while licorice is identified popularly in the public mind as a flavoring, it already has given industry such highly successful by-products as structural insulating board and fire-fighting foam. These are recovered from the spent root remaining after the extraction of the edible licorice products.

The long list of products for which the application of licorice and its derivatives has been used or considered includes root beer, chewing gum, flavoring extracts, detergents, chemical specialties, rubber latex stabilizer, animal feeds, agricultural sprays, cosmetics and rubber products.

WSE Personals

Donald R. Klusman, AWSE, formerly an engineer for the Illinois Bell Telephone Co., has moved to New York City where he has accepted a position as Accountant in the Developmental and Mechanization Section of the Fundamental Developments Group of the Comptroller's Department of the American Telephone and Telegraph Co., New York.

David C. Peterson, MWSE, at the first Board meeting subsequent to the meeting of the stockholders, was named to fill a new vice presidential post at Stewart-Warner. His new title is Director of Engineering and Manufacturing of Division One. This Division, in Chicago, is the company's largest division and producer of the Alemite line of lubrication products, electronic wheel balancers and Stewart-Warner automotive, industrial and other gauges and instruments.



Carl Persson has been promoted to Assistant Chief Engineer of Acme Steel Company, in charge of design of new machinery, equipment and accessories. He has been with Acme for 16 years, the first four years at the Archer Ave. plant and the past 12 years in Riverdale, as an engineer and designer. His home address is 14833 South Keeler Ave., Midlothian, Ill.

Dr. Ralph G. Owens, MWSE, Dean of Engineering of the Illinois Institute of Technology, has been elected Chairman of the Illinois-Indiana section of the American Society for Engineering Education. This is the highest post in the organization. **Frank W. Edwards,** MWSE, Director of the Department of Civil Engineering at Illinois Tech., was elected representative to the ASEE general council.

James S. Knowlson, MWSE, was reelected President and Board Chairman

of the Stewart-Warner Corp., at the annual meeting of stockholders held May 13, at Richmond, Va.

Verne O. McClurg, MWSE, Morrell M. Shoemaker and William M. McClurg announce the formation of the architectural and engineering firm of McClurg, Shoemaker and McClurg, to succeed the firm of Jensen and McClurg, with offices at 39 South La Salle Street, Chicago 3. The telephone is CEntral 6-5273.

Morton L. Pereira, MWSE, and Associates, architects and engineers, as of May 1, are occupying their new offices at 316 N. Michigan Ave., Chicago 1. The telephone is CEntral 6-1333.

Harold F. Sommerschield, MWSE, is now serving as Assistant to the Manager, Capitol Steel Division, Hausman Steel Co. His headquarters are in Lansing, Mich. Sommerschield spent many years as Structural Representative of the Portland Cement Association, and more recently was Chief Engineer of Abell-Howe Co., Chicago Contractor.

Fred T. Whiting, MWSE, a vice president of Westinghouse Electric Corporation, announced in Chicago on June 1, the appointment of **Marvin V. Maxwell,** MWSE, as Manager of the Engineering and Service Department.

Maxwell, who was formerly Assistant Manager of the Engineering and Service Department of the district, is widely known in the engineering profession.

He is a native of Carthage, Mo., and a graduate of the University of that state. He joined Westinghouse in 1924 and held positions at East Pittsburgh, Pa., Detroit, Denver and St. Louis before coming to Chicago in 1946.

Maxwell is an active member of the American Society of Mechanical Engineers, the American Institute of Electrical Engineers and the Western Society of Engineers, and Tau Beta Pi, Eta Kappa Nu and Pi Mu Epsilon fraternities.

Hubert C. Rett, AWSE, is now Telephone Engineer, Automatic Electric Co., Chicago.

Miss Patricia G. Lynch, MWSE, Technical Writer, is now with Lenkurt Electric Co., San Carlos, Calif.

John F. Foulkes, AWSE, is now Assistant Engineer, Lighting Section, Commonwealth Edison Co.

Alan Bate, MWSE, formerly Assistant Secretary, McGraw Electric Co., of Fostoria, Ohio, is now Chief Engineer, Oster Products Division, John Oster Manufacturing Co., Racine, Wis.

Lawrence Zeldin has joined the Madison laboratories of Bjorksten Research Laboratories, Inc. as a research chemist. Dr. Zeldin received a B. S. from C. C. N. Y. in 1946, and a Ph. D. from Ohio State in 1951. He was formerly a research associate doing research on aliphatic nitro and polynitro compounds at Ohio State.

E. Robertson Elected

The election of Elgin B. Robertson, president of the Elgin B. Robertson Co., Dallas, Tex., as president of the American Institute of Electrical Engineers, with a world-wide membership of more than 46,000, was announced June 15 at the opening session of the five-day Summer General Meeting of the Institute at the Chalfonte-Haddon Hall Hotel in Atlantic City, N. J.

The announcement was made at the annual meeting of the Institute by the committee of tellers which had tabulated mail ballots from Institute members, and was heard by more than 2,500 leading electrical engineers and scientists from many parts of the country and abroad.

Robertson, who has had a long career in industry and as a member of the Institute, will take office August 1, and serve until August 1, 1954.

A native of Meridan, Tex., Robertson, upon graduation from the University of Texas in 1915, was associated with the Westinghouse Electric Corp., until 1920 when he became chief electrical engineer for the Railway and Industrial Engineering Co., Greensburg, Pa. In 1928 he incorporated his own company and has since been president. He also is president of the Plastics Manufacturing Co. at Dallas.

He joined the War Production Board as production engineer in 1942.

Robertson has served the Institute as North Texas Section secretary and as Section Chairman. He has been chairman and a member of several Institute Committees and at present is a member of the Board of Directors.

Delta Tank Company is Building Third Plant

The Delta Tank Manufacturing Company, Inc. of Baton Rouge, La., the nation's largest manufacturer of containers for liquefied petroleum gas, is having a third manufacturing plant constructed at Beardstown, Ill.

The new plant, a 24,000-square-foot standardized steel-frame structure fabricated by the Luria Engineering Company of Bethlehem, Pa., will enable the concern to sharply step up its output of pressure vessels, tanks and cylinders for use as containers for liquefied petroleum gas.

The plant, scheduled for completion by next September, will also be used to increase fabrication of Delta Tank's Mix-O-Gas System, which the company prides itself on being "the most progressive tank in the nearly 20 years the LP-Gas industry has been in existence."

The concern's present manufacturing plants are in Baton Rouge and Macon, Ga.

Luria plans to deliver the 60 x 400-foot single-story superstructure to the Beardstown site by the first of July. Wessel & Sons, contractors of Beardstown, have received the contract to lay the foundation for the Luria building, as well as to erect an adjacent masonry air-conditioned office building.

Beardstown was selected by Delta Tank for its new plant, according to the company, because the location will facilitate service in the extensive middle-west farm area.

Future expansion plans provide for additional buildings in both Beardstown and Macon.

Firm Moves Research Center

Westinghouse Electric Corporation broke ground June 12 in Churchill Borough, Pa., for "the most modern Research Center in the electrical industry."

Dr. John A. Hutcheson, Westinghouse vice president and director of research, turned the first shovelful of earth at a ceremony held on a 70-acre plot about 10 miles east of downtown Pittsburgh's Golden Triangle.

The wooded and rolling land on which the new Research Center will be located is situated just south of the new Penn-Lincoln Parkway, near its intersection with the William Penn highway, and west of New Beulah road.

"When these new research facilities are completed early in 1955," Dr. Hutcheson said, "we will have the most modern Research Center in the entire electrical industry. It will be a place of beauty as well as efficiency, surrounded by trees and shrubs on well-landscaped lawns."

The Westinghouse executive said construction of the Research Center will not only give current company research activities a new home but will also provide the necessary space and flexibility to meet the requirements "placed on us by the expansion program of Westinghouse and by the growing electrical industry."

The new Research Center, designed by Voorhees, Walker, Foley & Smith, architects and engineers of New York, will be housed in an "L"-shaped, three-story building and will be built by Starrett Bros. & Eken, New York contractors who did the construction work on Pittsburgh's Gateway Center buildings. Coordinating the design and construction of the new laboratories is Dr. C. R. Hanna, associate director of the Westinghouse Research Laboratories.

"The Pittsburgh district is already recognized as the capital of the steel, aluminum, and other industries," Dr. Hutcheson declared, "but unfortunately it is not generally recognized that Pittsburgh is also one of the major centers of industrial research in the nation. Our new Research Center will help to emphasize the importance of this phase of modern industry."

John H. Elder, Jr., president of the Churchill Borough Council, hailed the construction of the Westinghouse Research Center as "an event which guarantees that Churchill Borough will continue to be noted for the beauty of its terrain."

"The citizens of the Borough are proud to welcome this new neighbor to their community," Mr. Elder said. "Not only will the beauty and desirability of the community increase, but undoubtedly the Westinghouse Research Center will also bring international prestige to this area."

Describing the new Center, Dr. Hutcheson said it will be approximately one-third larger than the present laboratories and will provide room for future expansion. In addition to laboratories and offices the structure will house a cafeteria capable of seating about 250 persons, an auditorium of similar size and a large technical library—one of the most completely equipped in the area.

The new Research Center will ultimately replace the present Westinghouse Research Laboratories located since 1916 in Forest Hills. Of the present staff there, only a small number will remain behind when it comes time for "the big move." For the time being, those who stay on at the old labs will continue research involving the use of special equipment such as that in the combustion laboratories, the 90-ton atom smasher and other equipment impractical to move. The giant, pear-shaped smasher, or Van de Graaf generator, is a familiar sight to motorists driving on the Lincoln highway past the Research Laboratories.

Dr. Hutcheson said that the continuing growth of the electrical industry clearly indicates a need in the future years for even larger research facilities at Westinghouse, and that the site chosen for the new Center will provide the land area needed for expansion.

"Since research is a constantly changing thing," he said, "flexibility will be vitally important in our new Research Center. For example, a scientist in the process of developing an idea frequently needs more space, or larger quarters. The design of the new lab is such that we will be able to enlarge the working area of the scientist by simply rearranging interior walls and facilities."

The Westinghouse vice president said the Churchill Borough site was selected as the location of the new Research Center only after company officials had studied many locations in other cities as well as in the Pittsburgh area.

"A major factor that swung our decision to stay in Pittsburgh was that this district is acting as well as talking when it comes to progressive community development. This is a growing area where people not only talk about problems but do something about them," he said.

New Concrete Method Speeds Construction

Construction time for concrete walls on all types of structures soon will be cut by as much as 50 per cent through increased application of the "Concretor Slip-Form System" that utilizes hydraulic jacks to raise the slip forms used for pouring concrete, according to *Construction Methods and Equipment,* McGraw-Hill publication, it was announced June 4, in New York.

As yet, no buildings have been poured in the United States with the Concretor System, introduced into this country from Sweden, but continuing development in forms and jacks has made it possible now to construct multi-story apartment houses, silos and bins in groups, multi-story factories and bridge piers, the magazine says. The system can be profitable on practically any structure that rises beyond a height of two or three stories.

In Stockholm, for example, the walls and flooring for one nine-story apartment house were built by 14 men working one shift a day, at the rate of one story a week; this represents about half the time and manpower that would have been required with conventional methods, the magazine says. Other seven- and eight-story buildings have been cast elsewhere in Europe. The method has been used here only for simple monolithic structures like silos and chimneys.

The jacks, called "hydraulic apes," raise slip forms by climbing up a smooth steel rod hand-over-hand like an ape. A large number of jacks can be operated simultaneously through remote control by one man who merely pushes a button. Concreting is continuous as the forms are raised slowly. By coordinating all phases of the job, it is possible to obtain a raising speed of 20 inches per hour with the concretor hydraulic jacks.

Experience has shown that window and door openings can be accommodated readily, and interior columns and beams can be built in as a building progresses.

Synthesis Gas Made in One Step

A new process whereby pulverized coal is converted in one step to synthesis gas, a mixture of carbon monoxide and hydrogen which is the base of over 100 of the world's most important chemicals, was explained before the American Gas Association in New York on May 27.

Speaking before the Production and Chemical Conference of the association at the Hotel New Yorker, Paul Grossman of the Research and Development Center of The Babcock & Wilcox Company, Alliance, Ohio said that the new process produced synthesis gas directly from pulverized coal in one operation, while the previous method was to convert the coal to coke and then in additional steps, convert the coke to synthesis gas. He also pointed out that the new process would produce the gas much more economically than the old method by permitting the use of lower grade coals, and would also lend itself to operation in widely diversified locations instead of only near beds of high grade coal.

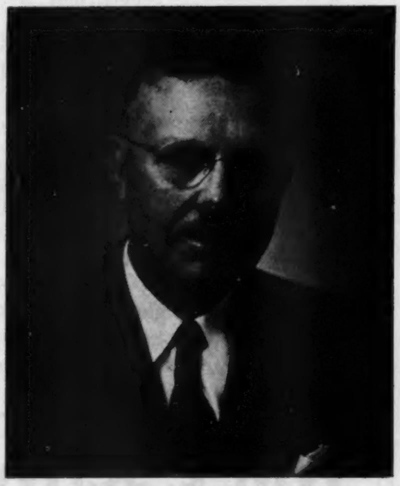
The company's 30 years experience in utilizing pulverized coal firing for large industrial boilers, Grossman said, was an important factor in the success of this development. The first pilot plant for using the new gasifying process was built by Babcock & Wilcox for the Bureau of Mines and went into operation at Morgantown, W. Va. in the summer of 1951. It burned about 500 pounds of coal per hour and produced 330,000 cubic feet of carbon monoxide and hydrogen gas per day, he said.

A larger size, semi-scale plant was built next for the Du Pont Company and was placed in operation at their Belle, W. Va. works in the fall of 1951. This plant converted 3000 pounds of coal per hour into gas, producing over 2,000,000 cubic feet per day. As a result of these early experiences, Grossman revealed that Du Pont has placed an order for a full scale plant with B&W which is scheduled to go into operation some time next year. Grossman said that he could not reveal the exact capacity of the new Du Pont plant, but revealed that it would be the largest single unit in the world for producing synthesis gas by either the old or the new method. He showed drawings of a typical full scale plant which converted 17 tons of coal per hour into synthesis gas and would produce about 25,000,000 cubic feet of this gas per day. The gas from this plant would be sufficient to supply the fuel needs of about 3,000 average homes.

To produce synthesis gas by this method, Grossman explained, pulverized coal, oxygen and superheated steam are sprayed through a burner nozzle into a refractory lined furnace. The molten slag and ash from the burning coal and oxygen drop to the bottom of the furnace and the gases rise and are drawn off for further processing into chemicals. The plant also utilizes the heat to produce steam for other purposes.

F. T. Whiting Honored

Fred T. Whiting, MWSE, a vice president of Westinghouse Electric Corp., and Ezra Taft Benson, United States Secretary of Agriculture, received honorary degrees from Iowa State College at commencement exercises held June 12 in Ames, Iowa.



Fred T. Whiting, MWSE

Whiting received the degree of doctor of engineering, and Benson the degree of doctor of agriculture. Both are graduates of Iowa State.

Whiting is a 1913 graduate of Iowa State with a bachelor of science degree in mechanical engineering. His entire business career has been with Westinghouse where he has established a record as an outstanding engineer and sales executive. In 1942 he received the "Westinghouse Order of Merit."

He has been a leader in his home city of Chicago in such organizations as the Chicago Association of Business and Commerce, and the Electric Association. He was a trustee of the Western Society of Engineers. Whiting is known as a proponent and participant in activities of the Community Chest, Boy Scouts of America, and the National 4-H Club Congress.

In 1946 Iowa State conferred upon him the Marston medal, awarded each year to a distinguished alumnus in the engineering profession.

Instrument Members Hear J. T. Rettaliata

More than 125 executives, Instrument Society of America members, and notables including Mayor Kennelly gathered June 11 in the Towers of the Conrad Hilton hotel in Chicago to listen to a keynote address by Dr. John T. Rettaliata, MWSE, president of Illinois Institute of Technology.

The occasion was a luncheon meeting of the Instrument Society of America to discuss the National Instrument conference in September. The society is concerned with promoting the science of instrumentation and automatic control in both industrial and scientific fields.

Following the opening remarks of Porter Hart, president of the I.S.A., Dr. Rettaliata spoke on "The Value of Instrumentation in Industry." "By banding together to advance the science of instrumentation," he said, "you are ushering in an Age tending toward complete automatic control. I'm glad I'm on hand to witness its arrival, for it is a thrilling spectacle and one I probably will like to tell to my grandchildren."

The Illinois Tech president went on to point out the vital role which the instrument and automatic control industry is playing in the moulding of a secure future for the nation. He said, "I know you will continue your work of advancing the science of instrumentation and control. Our technological society demands these tools for they are essential to progress.

"Instrumentation feels the pulse in a plant's operations," Rr. Rettaliata said in his closing remarks, "it removes the guesswork . . . and replaces it with immediate and accurate information . . . so vital to efficient performance."

Tree Industry Starts Research

The nation's lumber industry announced June 6 that it is launching a million-dollar research program designed to cut home building costs and give consumers new and better lumber products.

Leo V. Bodine, executive vice president of the National Lumber Manufacturers Association, said the program will guarantee the public "greater value for its lumber dollar through the development of new and improved uses for wood."

Major emphasis will be put on lamination—the gluing of two or more pieces of lumber in layers to give them greater strength than a solid piece of the same size.

The research project, largest organized program of its kind in the history of the lumber industry, will be set up by NLMA's Products and Research Committee, headed by D. B. Frampton, Columbus (Ohio) lumber manufacturer. It will involve a total outlay of $1,100,000 over a ten-year period to be financed by individual lumbermen and lumber companies.

In the first year, $100,000 will be spent for a detailed survey of past, present and potential lumber markets to give the industry a clearer picture of what markets offer the best sales opportunities. Another $100,000 will be spent the first year for actual research work on lamination.

This will be followed by the expenditure of $100,000 a year for the next nine years to finance additional lamination research. The Timber Engineering Co., an affiliate of the National Lumber Manufacturers Association, will conduct the lamination research.

End-products which the program is expected to develop include glued-up lumber panels faced with veneer, heavy-duty paper or thin fiberboard. Some of the panels may require no special facing.

"Indications are that builders could effect worthwhile economies by using these lumber panels for exterior wall and roof sheathing, sub-flooring and interior partitions," Mr. Bodine stated.

"The panels could be made of low-grade lumber without sacrificing quality or performance — a fact which in itself should save the builder money. At the same time, lamination may enable builders to obtain these lumber panels in sizes much larger than panels of competitive materials. Such a development would represent a potential saving in the cost of installing the panels. There also would be the advantage of additional strength."

Studding is another building item whose cost may be reduced through lamination, Mr. Bodine reported. He explained, for example, that there is an adequate supply of one-by-four-inch boards which lumbermen could laminate into two-by-four's.

Some specific objectives of the research program are to:

1. Find new uses in home building and other types of construction for small pieces of lumber and wood species which heretofore have had little or no commercial value. Wide, clear boards from narrow strips is one type of laminated building product which is expected to result from this effort.
2. Perfect economical methods for patching end-splits and other imperfections in wood to improve its performance and achieve a better utilization of waste material.
3. Develop a low-cost waterproof glue that is economical to apply and sets quickly at room temperature.
4. Develop a low-cost preservative treatment that can be applied to wood before lamination.
5. Cut the cost of laminating large structural members.
6. Perfect a technique for laminating combinations of different lumber species in the manner that metal manufacturers have developed the alloying of metals. For instance, the use of heavy, dense woods to face light weight woods would produce members with great strength in relation to their weight.

Crerar Library

News and Notes

A Bibliography of Awards in fields of science and technology is in preparation under sponsorship of the Special Libraries Association. This will include names of recipients of awards, the contributions for which the awards are granted and references to the published announcement. Miss Mildred Crew of the Illinois Institute of Technology Library Staff and Mr. William S. Budington and Mr. Ellis Mount of the Crerar staff have assisted in compiling information for awards granted by WSE or in which WSE is one of the participating associations. These will include the Charles Ellet Award, the Octave Chanute Award, the Washington Award and the Alfred Noble Prize. Publication date has not yet been announced.

* * *

Arrangements have just been completed with the Special Libraries Association for the deposit of the SLA Translations Pool in The John Crerar Library. The Pool includes a card index record of some 9,000 translations available from various sources, including more than 1,200 in copies available for loan or in photocopy. The Special Libraries Association will continue to sponsor the expansion of this collection in the interests of increased service to research. Crerar Library will lend any translation from the Pool to an inquirer for a nominal service fee, permit available paper copies to be used in the Library without charge, or supply photocopies at the Library's regular photoduplication service coupon rate.

William S. Budington, Crerar's Associate Librarian, was interviewed in Elkhart, Indiana for a June 30 broadcast over WTRC. The program, "Headlines in Chemistry," is a regular series sponsored by the St. Joseph Valley Section of the American Chemical Society. The subject of the interview with Mr. Budington was The John Crerar Library.

Rubber Road Survey Indicates Acceptance

The Natural Rubber Bureau, Washington, D. C., has conducted an independent survey of highway officials and engineers all over the country to find out what they thought of rubber roads. Answers from one in every fifteen officials, covering 47 states, would seem to indicate they think rubber roads very much a permanent part of the future highway scene.

Almost 100% of the officials know about rubber roads. One third of them already believe that the addition of rubber to asphalt is going to become a standard method of highway construction.

"The most significant finding in this survey," notes Harry K. Fisher, Road Consultant to the Natural Rubber Bureau, "is that nearly half the engineers could find no disadvantage at all with rubber roads. The only reservation of almost the entire remainder was additional cost. Rubber does add somewhat to the cost of laying a road. This is the *only* added cost, by the way, since all other factors remain exactly the same.

"Every day, however, we are coming closer to the day when results should prove that the small amount of rubber powder introduced into the mix—from 1½ to 5%—also adds longevity and less-repair factors that will more than make up for the added original cost. Once these cost-saving improvements are borne out, you can look to rubber-in-asphalt as a standard for highway construction before the next decade is over."

At the Natural Rubber Bureau Laboratory and in on-the-job tests all over the country, highway engineers and chemists are compiling information as to the exact advantages obtained by adding natural rubber powder to the asphalt mix. Up to now, this information is bearing out the rubber road's tendency to bleed less in summer, crack less in winter and better withstand traffic shock.

In the survey just completed, highway engineers indicated generally that three to five years of testing would give "a fair idea of the life expectancy of new surfacing materials." This country's oldest stretch of road incorporating natural rubber powder has now been down for about four years. If the engineers' test-time estimates are accurate, it shouldn't be too long before there are forthcoming some really definitive answers on the ability of rubber roads to cut costs by adding longer life and less repair to America's pavements.

According to researchers working on various rubber road projects, it looks as though those answers may well make rubber roads a standard part of America's future highway picture.

Copy of the complete survey detailing in full what American highway officials think of rubber roads, is available on request. Write to the Natural Rubber Bureau, 1631 K Street, N. W., Washington 6, D. C.

Lamme Gold Medal Awarded

One of engineering's outstanding awards, the Lamme Gold Medal, was presented to I. F. Kinnard, General Electric Co., West Lynn, Mass., at the opening session of the five-day Summer General Meeting of the American Institute of Electrical Engineers in Atlantic City, N. J., on June 15. The presentation was made by Donald A. Quarles, President of the Institute, for Mr. Kinnard's "outstanding contributions in design and developments in instrumentation and measurements."

In accepting the Medal, Mr. Kinnard, who is manager of engineering, meter and instrument department, General Electric, spoke on "Truth and Measurement," and stressed the importance of accurate measurements in science.

"In much of our work," he said, we apply known technical information, but real progress usually comes from the discovery by physicists and other scientists of new scientific facts. These are the truths that 'open the door' for the creative engineer, allowing him to make further practical advances for the benefit of mankind.

"Man's increasing ability to understand nature's secrets and to discover new scientific truths comes largely from his success in making accurate measurements. Likewise, the engineer finds that his problems become easier, and often quite simple, when he can measure and evaluate the facts of any given situation."

Mr. Kinnard, who has developed or been instrumental in developing the accurate watthour meter, modern long scale electrical instruments, photographic exposure meters and aircraft gyroscopes, observed that the watthour meter alone requires the accurate measurement of 150 separate quantities, and the total number of individual measurements may reach hundreds of thousands and take years to complete.

An aircraft gyroscope has adjustments to within 10 millionth of an inch, he said.

Mr. Kinnard is a native of Ontario, Canada, a graduate of Kingston University.

Director of Research for ASHVE is Dead

Cyril Tasker, Director of the Research Laboratory of The American Society of Heating and Ventilation Engineers, died suddenly on May 27, while returning from a meeting he had attended in Absecon, N. J. He succumbed to a heart attack in Warren, Ohio. Mr. Tasker was 54.

He had been director since 1943 and previously for 13 years was a member of the staff of the Ontario Research Foundation. As a senior research fellow at the foundation, he carried on important investigations relating to fuels, and a variety of problems connected with heating and air conditioning.

Tasker was born in Manchester, England, and was graduated from the University of Manchester in 1923 with the degree of M. Sc. (Tech). Until 1930, when he came to Canada, he was on the staff of the British Fuel Research Board. He became a member of ASHVE in 1935 and had served as a member of several committees, including the Committee on Research, and the ASHVE Council.

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(See details on page 2)

Reviews of Technical Books

Surveying

Surveying—Theory and Practice, by Raymond E. Davis and Francis S. Foote, McGraw-Hill Book Company, New York 18, N. Y., Fourth edition, 1953. 1021 pages. $8.00.

This text, as revised, should prove to be very popular with students and teachers of surveying. It may also find use by those in the field. The presentation of material, both of a theoretical and practical nature, is clear and complete.

New illustrations and numerical problems have been introduced. Many of the sections have been revised or rewritten. Photogrammetric surveying is well presented in a chapter by Colonel B. B. Talley, Corps of Engineers, U. S. Army.

The appendices include tables of refraction and parallax corrections, latitude coefficients, azimuths of polaris, variation of magnetic declination, stadia distances and elevations, weir coefficients, and logarithms.

J.G.D., W.S.E.

Thermodynamics

Basic Engineering Thermodynamics, by Vincent W. Young, McGraw-Hill Book Company, New York 18, N. Y. First Edition, 1952. 557 pages. $6.50.

In addition to the topics usually covered in the ordinary thermodynamics text written for a first course in the subject for undergraduates, the author of this book has included certain material which is generally presented in texts for advanced undergraduate or graduate instruction in engineering.

Only a few authors have included the material found in Chapter 8, General Thermodynamic Equations for the Pure Substance, in a text written especially for undergraduates. Maxwell's four thermodynamic relations are included in this chapter.

The material in Chapter 17, The Steady Flow of Fluids in Pipes and Ducts, has not been, up to this time, included in a text written expressly for the undergraduate. In fact very few authors of undergraduate texts in thermodynamics have mentioned "Fanno Lines" and the "Rayleigh Line" which are discussed in this text.

The subject matter is treated in a logical manner starting in Chapter 1 with Fundamental Definitions and Concepts. Then in order the first law and the closed system, the first law and the open system, and the reversible process and reversible cycle. The second law and entropy as a property of the system is then adequately discussed.

Applications of the first two laws of thermodynamics are made to perfect gases, mixtures of gases and vapors, steady flow of fluids and combustion.

The final chapter which deals with transmission of heat gives the student a very able introduction to this subject which is very essential to the engineer.

The book is well written and should be a valuable addition to the practicing engineer's library, as well as use as a text for undergraduate teaching.

R.G.O., W.S.E.

Plasticity

Introduction to the Theory of Plasticity for Engineers, by Oscar Hoffman and George Sachs, McGraw-Hill Book Company, New York 36, N. Y., first edition 1953. 276 pages. $6.50.

This book is written primarily for mechanical engineers who are grounded in the strength of materials and the calculus. The emphasis throughout is on the engineering aspects of the problems rather than the mathematics. In the first part (I) of the book the basic laws and theories necessary for an understanding of the theory of plasticity are taken up. The concepts of the stress tensor and the strain tensor are introduced in such a way as should appeal to engineers. Several plastic stress-strain relations are presented and a chapter is devoted to experimental data justifying particularly the two "laws" in common use.

In Part II are discussed the behavior of the thick-walled spherical shell and the thick-walled tube under internal pressure, and rotating cylinders and disks, all of ideally plastic materials. The final chapter in this part is concerned with general concepts of two-dimensional plastic flow of ideally plastic materials.

The interesting instability phenomena associated with reduction of section in uniaxial and biaxial tension are the subject of the main chapter in Part III.

Over forty per cent (Part IV) of the text is concerned with the theory of metal-forming processes. Drawing and extruding through circular and flat dies are discussed, including the effects of friction and backpull and of stationary and moving mandrels. One chapter covers rolling of sheet and strip, with and without tensions, and another deals with nonsymmetric problems of metal forming. Others take up forging, forming of thin-walled shells, and bending of plates.

Most of the chapters of the book are followed by references.

Civil engineers may be disappointed in not finding limit analysis discussed, and the important contributions of the Brown group are given scant, if indeed any, recognition. These deficiencies are covered in Prager's and Hodge's "Theory of Perfectly Plastic Solids," a valuable companion to Hoffman's and Sachs' book.

W.R.O.

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OVER THE MANAGER'S DESK

July is one of the vacation months and is usually a time when engineering work sort of coasts along. Why not change the pattern this year and make July a month for starting new things? By filling vacancies in your organization in July, your staff will be indoctrinated enough by September to swing into action with pep for the Fall.

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Utility Scholarships to be Offered

Twenty undergraduate scholarships will be offered annually by the Institute of Gas Technology, an affiliate of Illinois Institute of Technology, to help train engineers for careers in the utility gas industry.

The grants were announced June 9 by E. S. Pettyjohn, director of the Institute of Gas Technology in Chicago. Applications are now being accepted for the first 20 scholarships which begin in September, 1953.

"This marks the first time I.G.T. has sponsored undergraduate education," Pettyjohn explained, "and the program will be the only one of its kind in the United States."

The gas technology scholarships are available to students who have completed their sophomore year and who desire to take the gas technology option in either chemical or mechanical engineering at I.I.T.

The Institute of Gas Technology will pay one-half the recipient's tuition during his junior and senior years. The student must attend a summer term between his third and fourth years, but for this he will receive financial assistance in addition to his tuition. In 1953 this payment will be $300 for the 12 weeks.

Scholarship winners also will be given first consideration for Institute of Gas Technology graduate fellowships. These provide full tuition and a stipend more than adequate to meet living costs while the fellow studies for his master's degree. For men of demonstrated ability, the grant will be extended to include study for the doctorate.

The undergraduate scholarships in gas technology, while available only at Illinois Tech, are not restricted to I.I.T. students. Application for a scholarship may be made by any student in the United States or Canada who has sufficient credit hours to enter the junior year at I.I.T.

"A graduate of the gas technology program has an excellent opportunity for advancement in this field," Pettyjohn said. "The utility gas industry is now the nation's sixth largest industry and is growing rapidly.

"The gas industry serves more than 27 million homes," he said, "and in 1951 provided 22 per cent of the country's total energy requirements. More than five billion dollars was invested in it from 1946 to 1951, and an additional five billion is contemplated in the period 1952 to 1956."

The Institute of Gas Technology, a nonprofit corporation founded in 1941, is the gas industry's own educational and research facility. It is located on the campus of I.I.T., the nation's largest engineering college, on Chicago's near south side.

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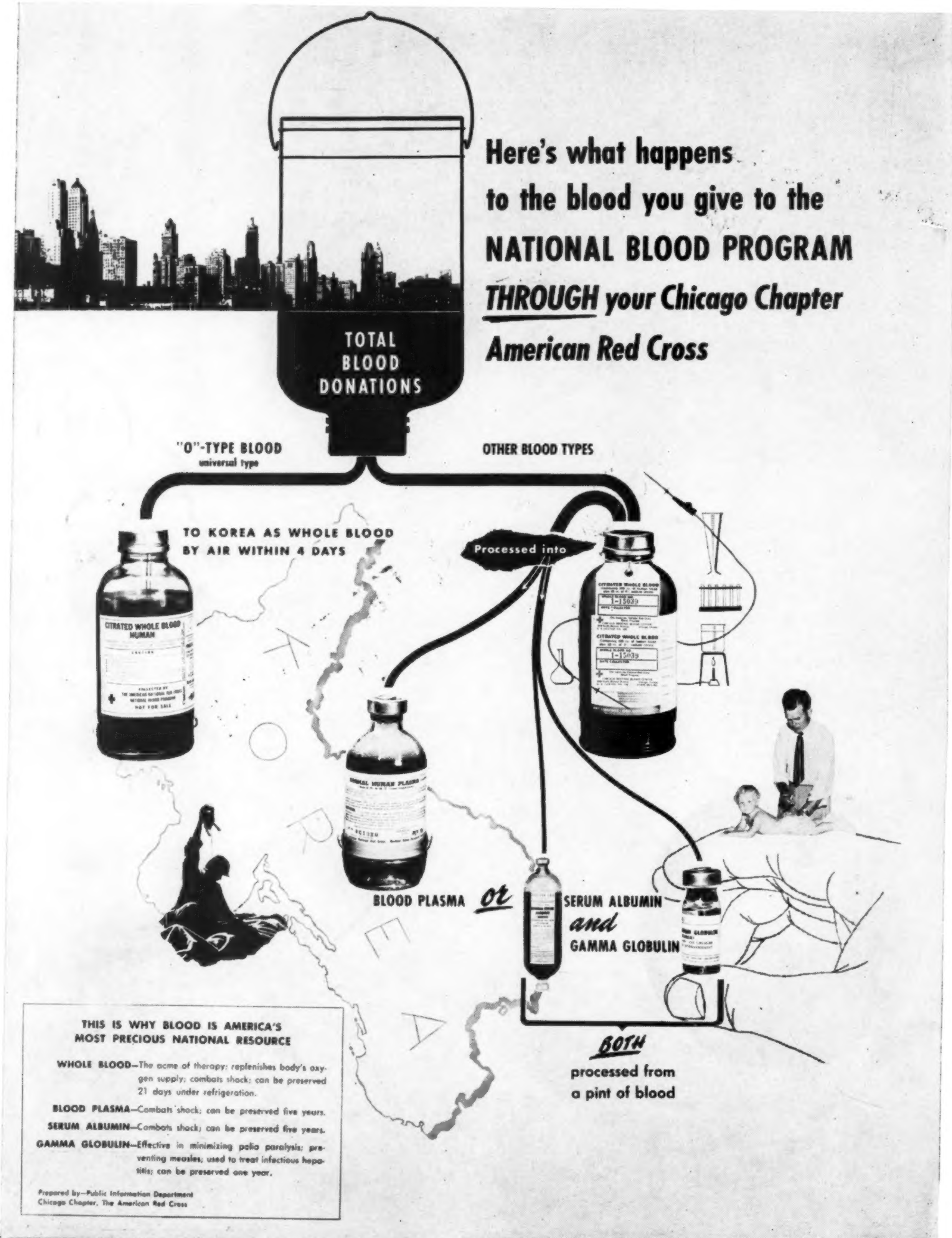
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